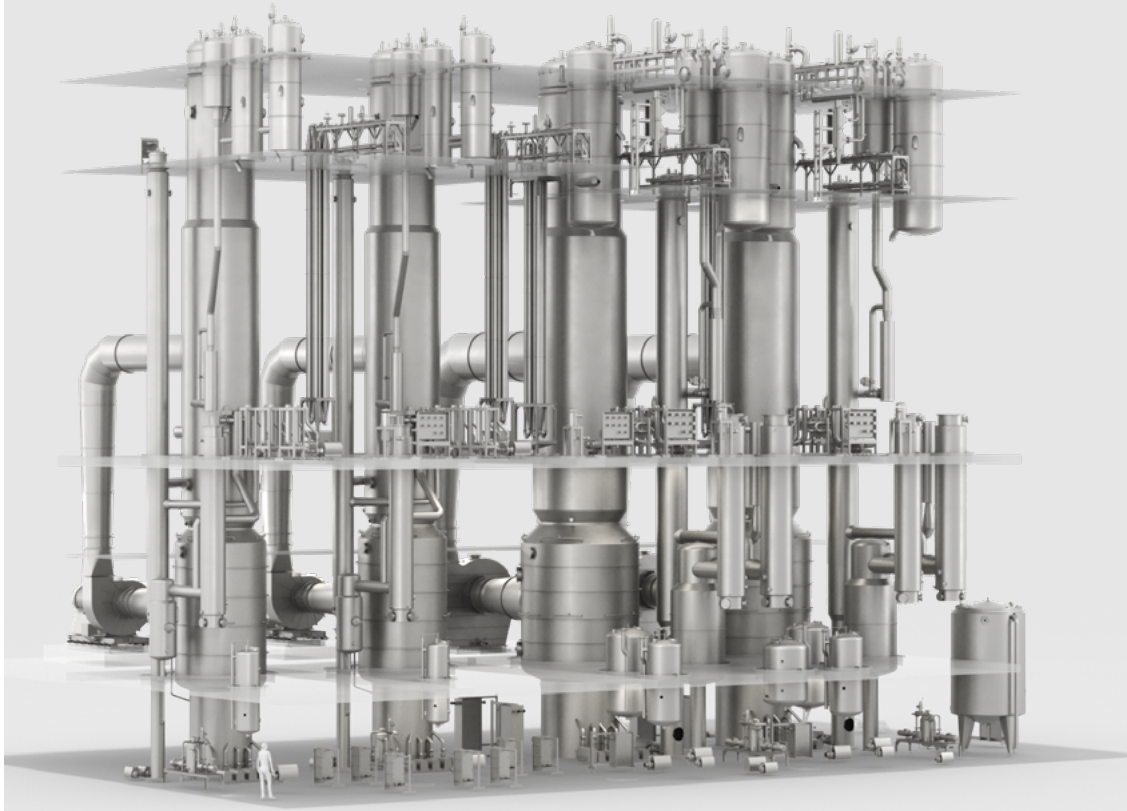
GEA DAIRY EVAPORATION

Your trusted partner.



GEA Engineering for a better world.

GEA.com

SHARING YOUR GOALS.

Safety, reliability, productivity, efficiency and the finest products for your customers.

At GEA, our focus has always been on you: how can we help you to serve your customers even better? We do this through a combination of engineering excellence and inspired plant design; the continual innovation of trusted technology to meet the needs of ever-changing markets; keeping our promises; and by using our knowledge, experience and expertise to keep you at the forefront, by improving processes, saving energy, and helping you to bring new products to market quickly and profitably.

We ensure operator and food safety as well as product quality by applying scrupulous hygiene and fast, effective cleaning (CIP). We share your aim to have reliability built in so that you can keep downtime to a minimum and productivity flying. By analyzing your requirements, we recommend the most fit for purpose technologies to ensure excellent product microbiology.

Then there is automation, the driving force behind efficiency, repeatability and traceability on which your business relies. It's the Total Cost of Ownership that matters, not just the capital expenditure. At GEA we base our solutions on the analysis of the TCO and provide you with access to our process, microbiology, energy and project management experts to serve you today and in the future.

APPLICATION OVERVIEW.

Whatever your dairy products, or markets, our experts will help you develop the processes and products you need to keep you ahead in a rapidly changing world. The GEA Dairy Evaporation Center of Competence has been serving our business continuously since the early 1950s, building first on field and empiric experience, then embracing digital technology. It allows us to propose robust and cutting-edge proven technologies, tailored to your precise needs.

We combine our many years of experience and engineering know-how to bring you complete production lines for your dairy products including liquid processing, membrane filtration, evaporation, spray drying and powder handling. We consider your overall range of products, energy costs, and long-term sustainability.

Our project management team applies the highest standards to keep you on time, on promise and meet your production requirements. People safety remains at the core of our concern, especially when it comes to process design, site erection and commissioning.

Cutting edge automation, based on S88 standards, helps limit human exposure to the `just necessary' and lets management steer the business. We can conduct feasibility trials for products and processes and explore the scientific background to all applications. We do this at our test centers with our pilot plants that include spray drying.

Our skilled engineers will help you to refine processes and perfect recipes to help you bring new products to market, quickly, efficiently and profitably. Our test centers include access to laboratory facilities that allow our technicians to study the behavior of small quantities of product at all stages of the process.

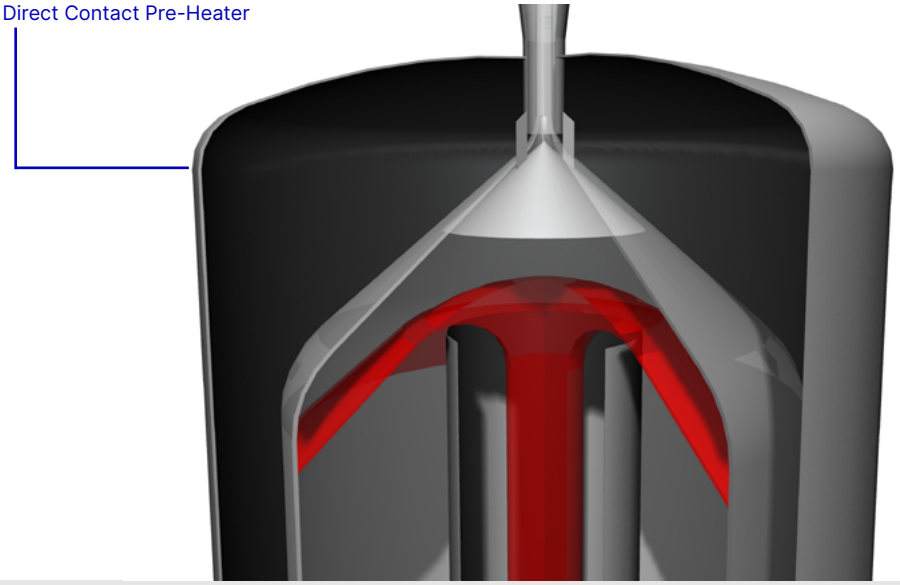
This allows the physical properties of products to be determined under all operating conditions to allow specific characteristics to be achieved.

Milk: skim milk, whole milk, buttermilk. dairy whitener, milk permeate, milk protein concentrate/isolate.

Specialties: infant formula, fat filled milk, fat filled whey, goat milk, camel milk, condensed milk, sweetened condensed milk.

Whey: crystallized whey, sweet/acid whey, demineralized whey, lactose, whey permeate, whey protein concentrate/isolate.

TECHNOLOGY OVERVIEW.



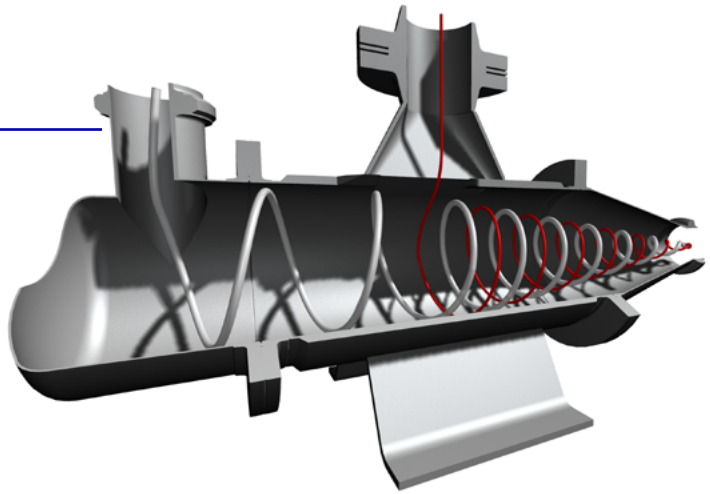
1. Pre-treatment

Pre-treatment increases the product temperature from cold storage up to boiling point. During this process, the product needs to be protected from any harm and limit bacterial development, in an economical way. The technologies we use are: **Direct contact preheating**: 'vapor mixed into liquid.' Our low mesophile and low thermophile preheaters help reduce bacterial development by reducing the heating surface and helping to increase the running time.
Indirect contact preheating: 'robust and cost effective'. Using a set of GEA liquid-liquid or liquid-vapor tubular or plate heat exchangers (EHEDG approved). It is the most economical solution with improved hygiene.

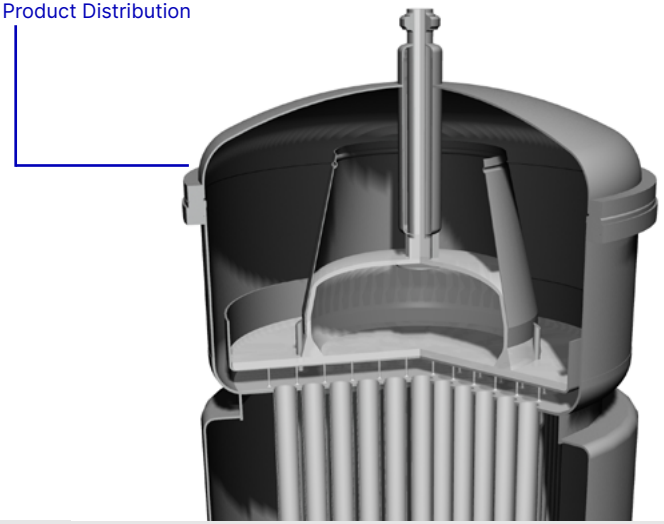
2. Heat-treatment

Involves the heating of the product from thermization up to UHT to tailor the product functionalities (denaturation and protein stability) as well as guaranteeing an excellent and safe microbiological profile for human and animal consumption.
GEA regenerative/flash vessels: recycle the energy and divide the steam consumption necessary for heat treatment by a factor of 2 to 4.
GEA tangential swirl heater: a direct steam injection device designed to reach the highest temperatures with minimum fouling and scorching.
GEA UHT plant: to provide indirect contact heating for the highest temperatures.
GEA infusion technology: for heating viscous and concentrated products.

Tangential Swirl Heater



Product Distribution



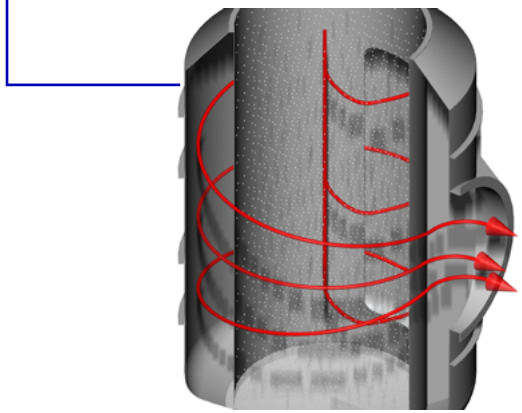
3. Evaporation

Evaporation concentrates the product for volume reduction prior to transport and before drying while keeping its tailor-made functionalities and minimizing the heat load on the product.
Hygienic design: easy to clean with minimum downtime and chemical usage. Vapor side and sanitation cleaning are possible.
Open type product distribution, product inlet from outside: hygienic and robust design (no chimney) with even distribution.
Open/semi closed/closed calandria top: designed to match each application, sight glasses for easy inspection, hygienic design.

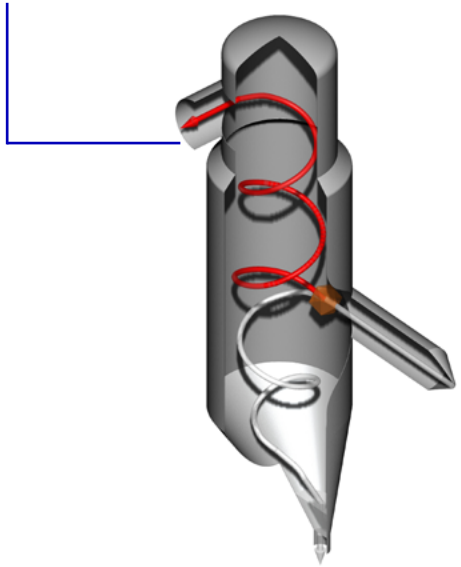
4. Separation

This involves the separation of the product liquid droplets from the vapor by centrifugal force. It's possible to achieve clean, transparent condensate and maximize product recovery.
Wrap around separator: integrated into the calandria foot for 360° separation and footprint reduction. Hygienic and optimized design, spray balls and easy inspection.
Tangential separator: installed adjacent to the calandria with tangential circular inlet, without baffles and/or angles, hygienic and easy inspection.

Tangential Separator



Flash Cooler



5. Post-treatment

This adjusts the product properties to match the subsequent process steps.
Flash cooler: used typically for instant cooling of whey/permeate/condensed milk, and instantaneous pre-crystallization without blockages.
Tubular re-heater: beneficial for sweetened and condensed milk.
Plate heat exchanger: for pre-concentrate cooling and heat recovery.

SMALL SCALE PRODUCTION PLANTS.

Standard small scale production plants range

We offer a full range of standard, free-standing falling film evaporators, all supplied as skid mounted units. The plants are pre-erected in our workshop, tested and delivered ready for plug-and-play connection to the product network and utilities.

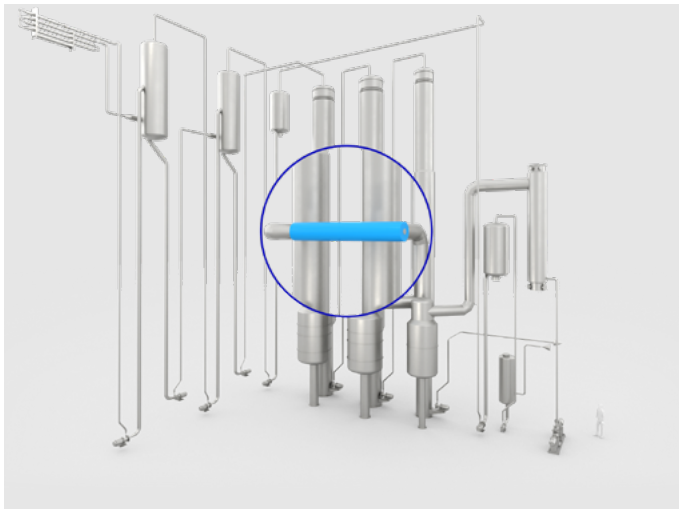
Evaporation capacity based on whole milk production

Plant size		FF-50	FF-100	FF-200	FF-400	FF-800	FF-1500	FF-2000
Feed: 12% TS, 25°C	kg/h	40	70	140	250	520	1050	1300
Evaporation	kg/h	29	51	103	183	381	770	953
Concentrate: 45% TS, 50°C	kg/h	11	19	37	67	139	280	347

THERMAL AND MECHANICAL SOLUTIONS.

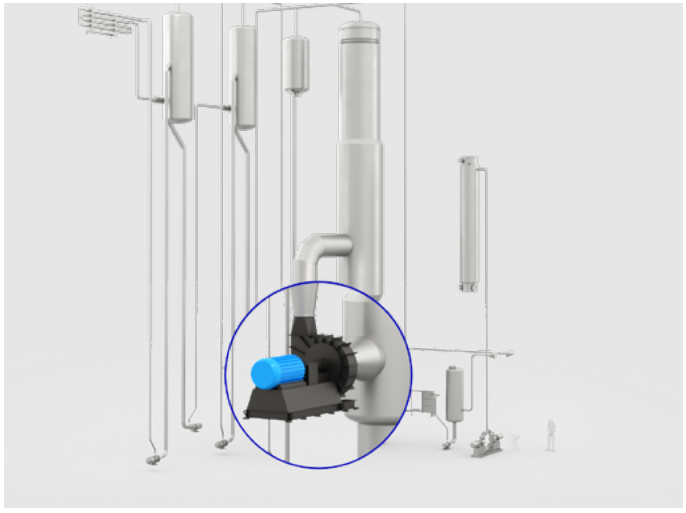
Thermal Vapour Recompression
TVR is applied to multi-effect evaporators in which live-steam is used to recompress product vapor with the resulting mix being used as a heating medium in the first effect. Generated product vapors are sent to the following effect and used as heating media, effect by effect. Unused vapor is condensed via a cooling tower.

TVR evaporators are suitable for small evaporation rate applications (below 5000 kg/h) or cases where steam is inexpensive to produce. Average specific consumption for the thermo-compressor is about 100 kWh per ton of evaporated water. The process generates warm condensates that can be returned to the boiler house and sent to the spray dryer preheaters.

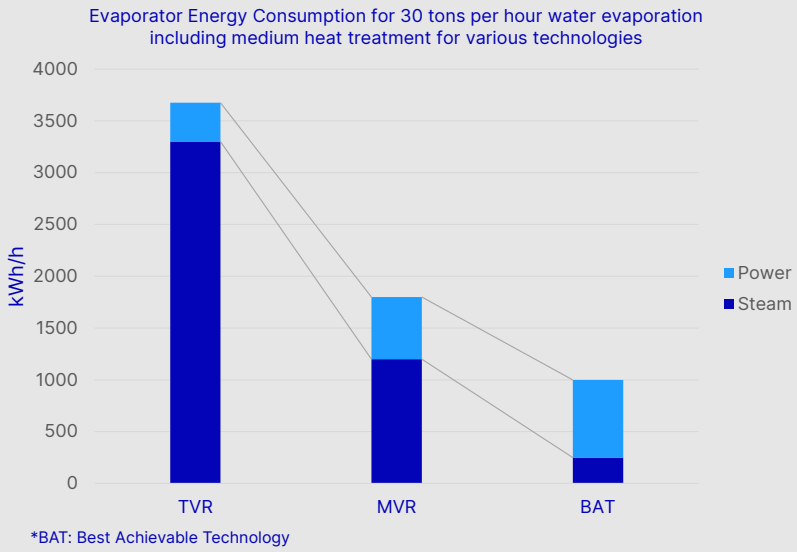


Mechanical Vapour Recompression
MVR is usually applied to single-effect evaporators where a compact design is required. Product vapor is recompressed and recycled to the heating side of the same effect using electricity. An MVR effect can be combined with another, or a TVR effect.

MVR evaporators are suitable for larger evaporation rates, in countries where electricity is easily available and steam is expensive to produce. Average specific consumption for the fan is about 15 kWh per ton of evaporated water. It generates cold condensates that can be easily treated by Reverse Osmosis allowing further use in a sustainable way and achieving the lowest CO_2 footprint.



SUSTAINABLE SOLUTIONS.



*BAT: Best Achievable Technology

Protecting the environment for future generations is important to all of us and reducing energy consumption saves operational costs too. So, at GEA, our engineering is focused on creating value for sustainable development through:

- Energy savings (pinch analysis and co-process)
- Decarbonation
- Total Cost of Ownership optimization
- Product quality and tailored functionalities with a minimum energy profile
- Hygienic design, CIP (clean-in-place) cost reduction and easy inspection
- Plant footprint reduction, lay-out and accessibility optimization
- Heat recovery / heat pump integration.

Examples of solutions

- Our Mechanical Vapor Recompression (MVR) evaporator consumes around 10 times less energy per kg of water removed than a classical Thermal Vapor Recompression (TVR) evaporator. Aside from its better efficiency, it also uses electricity instead of steam which allows for decarbonation of the plant. MVR evaporators are also available for finisher evaporators where the inlet concentrations are higher.

- Heat treatment lines are designed to be efficient both in terms of product quality and energy use
- Plate heat exchangers allow heat recovery while the hot water is removed from the milk
- Direct contact preheaters as well as regenerative and flash evaporation sections are also among the successful technologies we use to contribute to the higher energy savings.

These techniques have shorter heating time for a significantly higher temperature, making it possible to recover almost ¾ of the steam used at the heat treatment step. They also allow to improve the product quality by avoiding bacteria growth temperatures and having less product denaturation. Integration of utilities such as: hot water from heat pump connected elsewhere in the plant, or simpler passive heat recovery loops between processes or CIP can also help improve the overall efficiency of the evaporator or the plant.

Combined solutions for shared resources

Using our wide experience in process technology we have developed concepts that share the resources between various process elements to provide you with additional benefits. For example, by combining the evaporator's heat sources and spray dryer's needs, we can save up to 25% of the spray dryer's energy consumption.

Creating resources

Milk is about 90% water. When this water is extracted during the concentration process it's possible to reduce water consumption within the plant itself. The mineral load of this water is very low, and any residual contaminants can be removed using GEA's membrane filtration technology.

SERVICE PORTFOLIO

A range of services to maintain and improve the performance of your dairy evaporator:

Supported by a passionate and skilled GEA team
We have a strong team at GEA ready to help you with anything from sales to project execution, for a new plant or improving an existing facility. Whatever your requirement, GEA is your trusted partner for dairy evaporation.

Increased process stability and optimized evaporation
Evaporators can be difficult to optimize as they can be influenced by multiple external factors. With GEA OptiPartner, we control the inlet flow and energy supply to the evaporator simultaneously to stabilize and ease the process for the operator. Variations in inlet solids are handled automatically. Using digital technologies, such as advanced machine learning algorithms, GEA OptiPartner increases the efficiency and productivity with full visibility of the process.

Microbiology and product safety
Food safety and product quality are fundamental for your business. Make sure you meet the challenge, and protect your brand, with SAFEXPERT® services from GEA. SAFEXPERT® will help to diagnose the root cause of any existing processing problems, eliminating them and preventing any contamination in the future. GEA also benefits from an in-house microbiologist expert who ensures the plants are designed in the safest possible way.

Audit
To closely monitor and ensure the best working conditions for your plant, we propose a series of audits to correct process issues and optimize performance. These audits will help you to optimize the energy consumption, production costs, cleaning (CIP), hygiene and safety rules and quality of your production.

Training Services
Human error can occur at any time in a plant, resulting in lost production, impaired performance and reduced income. That's why we focus on a preventative approach that includes providing theoretical and hands-on training for your staff. Our training modules are designed and delivered by our specialists to give your production personnel the knowledge they need to operate a dairy evaporation process efficiently.

Spare parts
During the commissioning of the plant, we will recommend an inventory of critical spares to cover all maintenance needs. Our comprehensive spare parts service will give you access to genuine parts throughout the operating life of your plant.

Maintenance MVR
We will provide you with support for your planned and preventive maintenance programs. For critical equipment, such as the compressor, we will perform an annual inspection and a complete overhaul after five years of operation.

GEA Service Level Agreements (SLA)
We have developed a modular Service offering to support you during the lifetime of your plant. Our SLA uses data and knowledge of your service demands to provide you with a true customized program that will help eliminate operational and maintenance concerns, meeting your specific needs.

GEA Assist is a secure web-based application designed to host and manage a variety of online services for GEA customers.

Get instantly connected with GEA Remote Support
We are always looking to improve your service experience and with our Remote Support concept, we are not just offering you a video tool: we give you access to our expert knowledge, stay close and provide dynamic access to our experts and Field Service Personnel.

Engineering for a better world.

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